CLAIMS

1. A process for the plasma deposition of a layer of microcrystalline semiconductor material, wherein a process gas which includes a precursor of the semiconductor material and a diluent is energized with electromagnetic energy so as to create a plasma therefrom, which plasma deposits a layer of said microcrystalline semiconductor material onto a substrate, wherein the improvement comprises:

varying the concentration of the diluent in said process gas as a function of the thickness of the layer of microcrystalline semiconductor material which has been deposited.

2. The process of claim 1, wherein the concentration of said diluent is decreased as the thickness of said layer increases.

3. The process of claim 1, wherein the concentration of said diluent is varied in a stepwise manner as the thickness of said layer increases.

4. The process of claim 1, wherein the concentration of said diluent is varied as a continuous function of the thickness of the layer.

5. The process of claim 1, wherein said microcrystalline semiconductor material includes a group IV element.

6. The process of claim 1, wherein said process gas comprises a member selected from the group consisting of: SiH_4, Si_2H_6, GeH_4, SiF_4, GeF_4 and combinations thereof.

7. The process of claim 1, wherein said diluent is selected from the group consisting of hydrogen, deuterium, a halogen and combinations thereof.

8. The process of claim 4, wherein said diluent comprises hydrogen.

9. The process of claim 1, wherein said electromagnetic energy is microwave energy.

10. The process of claim 1, wherein said electromagnetic energy is radiofrequency energy.

11. The method of claim 1, wherein the step of varying the concentration of the diluent in the process gas comprises changing the amount of the diluent in said process gas.

12. The method of claim 1, wherein the step of varying the concentration of the diluent in the process gas comprises changing the amount of the semiconductor precursor in the process gas.

13. The process of claim 1, including the further step of varying at least one other deposition parameter as a function of the thickness of the layer of microcrystalline semiconductor material which has been deposited, said other deposition parameter being selected from the group consisting of: process gas pressure, power density of said electromagnetic energy, frequency of said electromagnetic energy, and substrate temperature.

14. The process of claim 1, wherein said semiconductor material includes silicon and germanium therein and wherein said process gas includes a silicon-containing compound, a germanium-containing compound, and a diluent selected from the group consisting of hydrogen, deuterium and combinations thereof, and wherein the ratio of said silicon-containing compound to said germanium-containing compound is varied while said semiconductor material is being deposited so that the silicon/germanium ratio of said layer of semiconductor material varies as a function of layer thickness; and wherein the concentration of said diluent gas in the process gas is increased as the ratio of said germanium-containing compound to said silicon-containing compound therein increases.

15. A method for the manufacture of an N-I-P type photovoltaic device, said method comprising the steps of:

providing a substrate;

depositing a first, doped layer of a semiconductor material on said substrate;

depositing a microcrystalline layer of a substantially intrinsic semiconductor material upon said first doped layer by a plasma deposition process wherein a process gas which includes a precursor of the substantially intrinsic semiconductor material and a diluent is energized with electromagnetic energy so as to create a plasma therefrom, which plasma deposits said layer of microcrystalline, substantially intrinsic semiconductor material; wherein the process includes the step of decreasing the concentration of the diluent in the process gas as a function of the thickness of the layer of microcrystalline, substantially intrinsic semiconductor material which has been deposited; and

depositing a second doped layer, of a conductivity opposite that of said first doped layer, atop said body of microcrystalline, substantially intrinsic semiconductor alloy material.

16. The process of claim 15, wherein the microcrystalline, substantially intrinsic semiconductor material includes a group IV element therein.

17. The method of claim 16, wherein said group IV element is selected from the group consisting of silicon, germanium, and combinations thereof.

18. The method of claim 15, wherein said diluent is selected from the group consisting of hydrogen, deuterium, a halogen and combinations thereof.

19. The method of claim 18, wherein said diluent comprises hydrogen.

20. The process of claim 15, wherein said electromagnetic energy is microwave energy.

21. The method of claim 15, wherein said electromagnetic energy is radiofrequency energy.